

GPSPCI and GPSISA

TIME SYNCHRONIZATION CARDS



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DISCLAIMER

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Masterclock shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

See important *limited warranty* information starting on page 7.

ADVISORY NOTICE

CONCERNING GPS SATELLITE SYSTEM AND THE GPSPC TIME CODE GENERATOR

Depending on many factors beyond the control of Masterclock, the signals that are received from the GPS Satellites **are subject to interference, fading, satellite failure and other influences *that could cause*** the GPSPC to generate erroneous time and/or date information and, under some conditions, ***could prevent*** it from generating a time code signal and or cause it to generate an erroneous time code signal.

It is the responsibility of the user to determine the adequacy and suitability of this device for the intended use.

INTRODUCTION

The GPSPC is a PCI or ISA PC card that provides very stable accurate time and date information for a Windows/NT PC. The card receives reference time information from Atomic Clocks in the GPS (Global Positioning System) satellites.

GPS SATELLITES

The GPS satellites are operated and maintained by the US Department of Defense and allow for the precise determination of local time and location at any point on (or above) the Earth. This is accomplished via the transmission of very accurate timing information from a series of satellites that provide coverage of the entire planet.

The GPSPC extracts timing reference from these signals and generates time information to the PC that is synchronized to within less than 10 microseconds of UTC (Universal Coordinated or Greenwich Mean Time).

UTC/GREENWICH MEAN TIME

UTC is the local time at the prime reference meridian at Greenwich, England. At a given location on the planet, local time can be displaced (referenced to UTC) by -11 to +12 hours. North and South America are from -3 to -11 hours delayed; most of Europe and Africa and all of Asia and Australia are advanced by +1 to +12 hours.

TIME ZONES & DAYLIGHT SAVING TIME

The GPSPC provides UTC to the PC's operating system. Time zone offsets and daylight savings time are handled as a standard feature of the operating system.

INITIAL OPERATION

Each GPSPC is thoroughly tested with its external antenna prior to shipment. Physical installation is simply a matter of installing the card into a PCI or ISA bus slot and connecting the antenna.

OPERATING THE GPSPC FOR THE FIRST TIME

When the GPSPC is initially powered up, after having been shipped to a new location, the time to first fix (time the unit takes to acquire satellites and extract correct time) could be up to 25 minutes although it is typically 5 - 15 minutes. Factors such as atmospheric conditions, type of antenna, antenna location, and antenna cable length will affect the time to first fix.

The GPSPC will provide time from an internal on-board clock whenever GPS time is not available. The onboard clock runs from a backup battery in the absence of power from the PC.

The GPSPC's GPS navigation module has its own backup battery that maintains startup data when the PC is powered down. If, when starting up, the location, time and number of satellites that the GPSPC can receive has not changed significantly since last power down, then the GPSPC time will be available much faster.

ANTENNA LOCATION

Depending on the type of building where the GPSPC is located and obstructions that may block reception of signals from the GPS satellites, the antenna may have to be located where it has an unobstructed view of the sky. In some cases this can be accomplished by placing the antenna adjacent to a window. In most cases it will require mounting it outside of the building or on a roof. In the worse case, the basic requirement for assured system operation is that the antenna module has a clear and unobstructed view of the sky for initial

satellite acquisition and lock (generation of time information by the GPSPC). It is possible that the system will operate indoors and under other obstructions. However this can only be determined empirically; it is not guaranteed.

If a longer cable is required, cables of various lengths (up to 500 feet) with pre-amplified antennas are available from Masterclock. *Bringing the GPSPC up for the first time with an indoor antenna may prevent or significantly increase the time to first fix.*

INITIAL OPERATIONS AND I/O CONNECTIONS

1. Locate the antenna in a suitable area so that the top of the antenna module has a clear view of the sky. Do not move it until after the GPSPC has initiated operation (explained below).
2. Connect the antenna coax to the SMA connector on the PC card bracket.
3. The unit first calculates coordinates and distances for acquisition of GPS satellites. The LED will remain off until satellites are acquired and precise location and timing references are established.

NORMAL OPERATION

After acquisition of satellites the GPSPC will begin generating time information and the card LED will illuminate steadily.

FREEWHEELING

During continuous operation it is likely that the GPSPC will experience occasional outages and loss of satellite reference time. This can be caused by atmospheric and many other outside conditions which are essentially unavoidable with a simplex system. Such signal losses can last from a few minutes to hours. When the condition disappears and the unit re-acquires satellite timing reference, it will automatically resync to the satellite time reference.

During such outages the GPSPC will continue to generate time information referenced to the last available satellite timing information. This mode is referred to as freewheeling. When the unit first acquires satellite time, it calibrates an internal reference oscillator against the incoming atomic time. During freewheeling the time information will be referenced to this calibrated oscillator and will typically be accurate to within a few milliseconds over a 24 hour period (if the power is not disconnected). As is covered in other areas of this instruction book, the freewheeling status is encoded/decoded by the TCRSYNC software supplied by Masterclock and the operator is given the option of synchronizing to the time information during the freewheeling state.

The transition to and from freewheeling mode is seamless - it does not interrupt time information output.

FREEWHEELING/NON LOCKED LED INDICATION

During a freewheeling period the card LED will be off.

HARDWARE

OPERATING ENVIRONMENT

The GPSPC is not water or moisture proof. Treat it as you would any other delicate electronic device and do not expose it to water, excessive heat or physical abuse.

DB-9 CONNECTIONS

Pin 1 - Pulse Out

TTL-level 100ms active low pulse generated once per second by the GPS receiver. The negative-going edge of the pulse is aligned with UTC (Greenwich Mean Time) when the receiver has a 3-dimensional GPS satellite fix. This pulse is not available when the GPSPC is first powered on. The pulse may become unavailable if the receiver loses GPS satellite fix for an extended period of time. Accuracy of this pulse (when synchronized to GPS satellite) is nominally $\pm 1\mu s$.

Pin 2 - RS-232 RX

RS-232 receive line.

Pin 3 - RS-232 TX

RS-232 transmit line.

Pin 4 - NC

No connect.

Pin 5 - Ground

Connect this pin to the ground of any host communicating to the GPSPC via RS-232.

Pin 6, 7, 8 and 9- NC

No connect.

COMMUNICATING VIA RS-232

The GPSPC supports a robust protocol for determining operation status. The following lists some of the information available to the user:

- GPSPC status bits
- GPS receiver diagnostics
- GPS fix status and type
- UTC and generate time (including frame rate output)
- Enhanced time zone and daylight savings time configuration capability

The full GPSPC RS-232 protocol specification is available for download at the Masterclock, Inc. home page on World Wide Web (<http://www.masterclock.com>). See the GPSPC section in the [Downloadable Files](#) area.

The jumper J1 on the GPSPCI card determines what device has control of the GPS module. If jumpered 1-2 (Factory Default), then the microcontroller on board has control of the GPS module. If jumpered 2-3, then a serial device

connected to the DB-9 can control of the GPS module. In either case, the control information sent to the GPS module is echoed on TP2. NOTE: If a serial device connected to the DB-9 is controlling the GPS module, information from the card will be unavailable to the PC in which it is installed.

PRE-AMPLIFIED ANTENNA

The GPSPC requires a pre-amplified antenna. It provides 5 VDC via the center pin of the coaxial for remote power. **Warning: Attaching a passive (non pre-amplified) antenna to the GPSPC could destroy the GPS receiver module. This is a major repair cost, which is not covered by warranty.**

The unit is tested and shipped with the appropriate cable for the antenna that was ordered. Should you require a longer antenna cable we recommend that you contact Masterclock so that a properly matched cable and antenna can be supplied.

Although changing the GPS antenna or coaxial cable is not technically difficult, you are on your own should you decide to make such changes. We do not warrant or support operation with any hardware not installed or supplied by us.

ANTENNA COAXIAL CABLE

The coaxial cable should not be crushed, crimped or bent at a sharp angle nor should it be strained by pulling. Any damage to the cable could result in the GPSPC not functioning properly. If the cable is to be coiled for storage, the coil diameter should be at least 6”.

PROBLEMS - TROUBLE SHOOTING

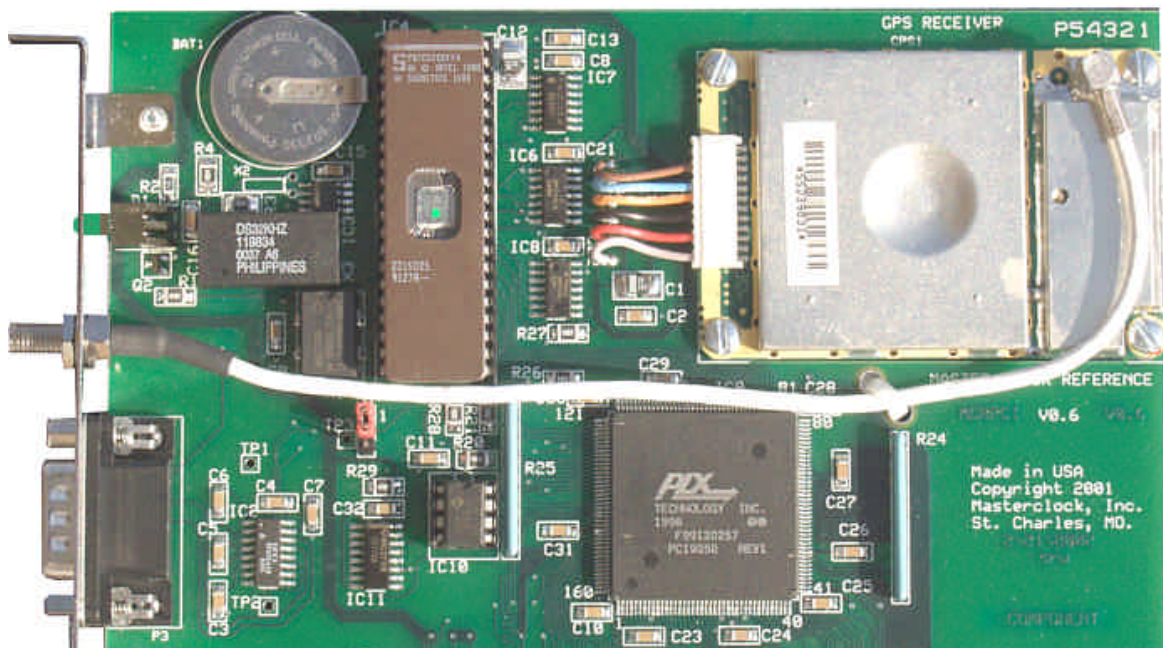
All GPSPC units are checked for proper operation before shipment. Unless physical damage is found, the unit has been proven to be functional at the factory.

Please remember for an initial startup at a new location the unit could take up to 30 minutes. After the unit has acquired satellites at the new location, the startup time is greatly reduced to anywhere from a few seconds to several minutes.

If the antenna (and coaxial cable) has not been damaged and has an unobstructed view of the sky, the power connector is properly installed and the front panel LED follows the startup sequence described earlier (on, off & then on), the unit is working.

If you continue to have problems even after the above precautions have been noted please contact the factory.

PC BOARD LAYOUT



SPECIFICATIONS

OUTPUT

TIMING CHARACTERISTICS

Reference:.....UTC/GMT (default)
Date
Short term accuracy.....+/- 10 μ s
Long term stability.....same as GPS atomic clock

POWER SUPPLY REQUIREMENTS

Contains its own CPU and requires only DC power from the PC

PHYSICAL

1/3 slot AT/PCI card

OPERATING TEMPERATURE

Temperature.....0 to +70 °

PRE-AMPLIFIED ANTENNA

Frequency	1575 MHz \pm 10 MHz
Polarization	Right Hand Circular
Impedance.....	50 Ohm
Weight.....	8.3 Oz (235 gr.)
Voltage	5 VDC
Power Consumption	@ 20 ma (.24W)
Gain	26 DB Standard
Temperature	-40 to +70°

COAXIAL CABLE

Type	51 Ohm low loss - RG-58A/U (Belden 8219 or equivalent) TNC connectors
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OPTIONS

TCRSYNC-NTP Software

NTP Time Server Software for use with GPSPC, MCRPC, and TCR500 PC cards.

GPSPC ANTENNA OPTIONS

PKG -1

GPSPC with 100'/30m, 1/4"/.6cm Coax

PKG -2

GPSPC with 150'/45m, 1/4"/.6cm Coax

PKG -3

GPSPC, 200'/61m - 1/2" Coax, 2 each N to TNC Adapters

PKG -4

GPSPC, 250'/75m - 1/2" Coax, 2 each N to TNC Adapters

LIMITED WARRANTY

This Masterclock Inc. (hereinafter Masterclock) product warranty extends to the original purchaser.

Masterclock warrants the GPSPC against defects in materials and workmanship for a period of one year from date of sale. If Masterclock receives notice of such defects during the warranty period, Masterclock will, at its option, either repair or replace products that prove to be defective.

Should Masterclock be unable to repair or replace the product within a reasonable amount of time, the customer's alternate remedy shall be a refund of the purchase price upon return of the product to Masterclock. This warranty gives the customer specific legal rights. Other rights, which vary from state to state or province to province, may be available.

EXCLUSIONS

The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product or improper site preparation and maintenance (if applicable).

WARRANTY LIMITATIONS

MASTERCLOCK MAKES NO OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THIS PRODUCT. MASTERCLOCK SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In any state or province which does not allow the foregoing disclaimer, any implied warranty of merchantability or fitness for a particular purpose imposed by law in those states or provinces is limited to the one-year duration of the written warranty.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL MASTERCLOCK BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

In any state or province that does not allow the foregoing exclusion or limitation of incidental or consequential damages, the customer may have other remedies.

HARDWARE SERVICE

You may return your GPSPC to Masterclock for repair service. Please contact the factory for return authorization before returning the unit.